

CLAIMS

1. A data processing device comprising:
improvement information generating means for generating improvement information for improving quality of data; and
embedding means for embedding the improvement information into the data.
2. The data processing device as claimed in claim 1, wherein the improvement information generating means generates a prediction coefficient used for predicting a prediction value of quality-improved data obtained by improving the quality of the data, as the improvement information.
3. The data processing device as claimed in claim 2, wherein the improvement information generating means generates the prediction coefficient for each predetermined class.
4. The data processing device as claimed in claim 3, wherein the improvement information generating means comprises:
class tap constructing means for constructing a class tap used for finding a class of target teacher data of teacher data to be a teacher, by using learner data to be a learner;
classifying means for carrying out classification for finding the class among the target teacher data on a basis of the class tap;
prediction tap constructing means for constructing a prediction tap used together with the prediction coefficient for predicting the target teacher data, by using

the learner data; and

prediction coefficient operation means for finding the prediction coefficient for each class by using the teacher data and the prediction tap.

5. The data processing device as claimed in claim 4, wherein the improvement information generating means generates a plurality of types of improvement information.

6. The data processing device as claimed in claim 5, wherein the improvement information generating means generates prediction coefficients for different number of classes as the plurality of types of improvement information.

7. The data processing device as claimed in claim 5, wherein the improvement information generating means generates a plurality of types of prediction coefficients found by using learner data or teacher data of different qualities, as the plurality of types of improvement information.

8. The data processing device as claimed in claim 5, wherein the improvement information generating means generates at least the prediction coefficient and information for carrying out linear interpolation, as the plurality of types of improvement information.

9. The data processing device as claimed in claim 5, wherein the improvement information generating means generates a plurality of types of prediction coefficients found by using class taps or prediction taps of different structures, as the plurality of types of improvement information.

10. The data processing device as claimed in claim 5, wherein the improvement information generating means generates a plurality of types of prediction coefficients found by carrying out classification by different methods, as the plurality of types of improvement information.

11. The data processing device as claimed in claim 1, wherein the improvement information generating means generates, as the improvement information, a class code expressing the class of the data, used for predicting the prediction value of the quality-improved data obtained by improving the quality of the data.

12. The data processing device as claimed in claim 11, wherein the improvement information generating means comprises:

prediction tap constructing means for constructing a prediction tap used for predicting target teacher data of teacher data to be a teacher, by using learner data to be a learner;

prediction coefficient storage means for storing a prediction coefficient for each class code found by learning;

predictive operation means for finding a prediction value of the target teacher data by using the prediction tap and the prediction coefficient; and

class code detecting means for detecting the class code of a prediction coefficient that minimizes the prediction value of the target teacher data; and

wherein the improvement information generating means outputs the class code detected by the class code detecting means, as the improvement information.

13. The data processing device as claimed in claim 11, wherein the improvement information generating means comprises:

class tap constructing means for generating a class tap used for finding the class of target teacher data of teacher data to be a teacher, by using the teacher data; and

classifying means for carrying out classification for finding the class of the target teacher data on the basis of the class tap; and

wherein the improvement information generating means outputs a class code corresponding to the class found by the classification means, as the improvement information.

14. The data processing device as claimed in claim 1, wherein the embedding means embeds the improvement information into the data so that the data and the improvement information can be restored, by using a bias of energy held by the data.

15. The data processing device as claimed in claim 1, wherein the embedding means embeds the improvement information into the data by carrying out spectrum spreading.

16. The data processing device as claimed in claim 1, wherein the embedding means embeds the improvement information into the data by changing one or more bits of the data to the improvement information.

17. The data processing device as claimed in claim 1, wherein the data is image data and the improvement information is information for improving image quality of the image data.

18. A data processing method comprising:
an improvement information generating step of generating improvement information for improving quality of data; and
an embedding step of embedding the improvement information into the data.
19. A recording medium having recorded thereon a program to be executed by a computer, the program comprising:
an improvement information generating step of generating improvement information for improving quality of data; and
an embedding step of embedding the improvement information into the data.
20. A program to be executed by a computer, the program comprising:
an improvement information generating step of generating improvement information for improving quality of data; and
an embedding step of embedding the improvement information into the data.
21. A data processing device for processing embedded data obtained by embedding improvement information for improving quality of data into the data, the device comprising:
extracting means for extracting the improvement information from the embedded data; and
improving means for improving the quality of the data by using the improvement information.
22. The data processing device as claimed in claim 21, wherein the improvement

information is a prediction coefficient used for predicting a prediction value of quality-improved data obtained by improving the quality of the data, and the improving means finds the prediction value of the quality-improved data by using the data and the prediction coefficient.

23. The data processing device as claimed in claim 22, wherein the improvement information is a prediction coefficient found for each predetermined class, and the improving means finds the prediction value of the quality-improved data by using the data and the prediction coefficient for each class.

24. The data processing device as claimed in claim 23, wherein the improving means comprises:

class tap constructing means for constructing a class tap used for finding a class of target quality-improved data, which is targeted quality-improved data, by using the data;

classifying means for carrying out classification for finding the class of the target quality-improved data on the basis of the class tap;

prediction tap constructing means for constructing a prediction tap used together with a prediction coefficient for predicting the target quality-improved data, by using the data; and

predicting means for finding a prediction value of the target quality-improved data by using the prediction coefficient of the class of the target quality-improved data and the prediction tap.

25. The data processing device as claimed in claim 21, wherein the improvement information is a class code expressing the class of a prediction coefficient for each predetermined class used for predicting a prediction value of quality-improved data obtained by improving the quality of data, and the improving means finds the prediction value of the quality-improved data by using the data and the prediction coefficient corresponding to the class code.

26. The data processing device as claimed in claim 25, wherein the improving means comprises:

prediction tap constructing means for constructing a prediction tap used together with a prediction coefficient for predicting target quality-improved data, which is targeted quality-improved data, by using the data; and

predicting means for finding a prediction value of the target quality-improved data by using the prediction coefficient corresponding to the class code as the improvement information and the prediction tap.

27. The data processing device as claimed in claim 24, wherein a plurality of types of improvement information are embedded in the embedded data.

28. The data processing device as claimed in claim 27, wherein the prediction coefficients for different numbers of classes are embedded in the embedded data as the plurality of types of improvement information.

29. The data processing device as claimed in claim 27, wherein the prediction coefficient is generated by using learner data to be a learner and teacher data to be a

teacher, and a plurality of types of prediction coefficients found by using learner data or teacher data of different qualities are embedded in the embedded data as the plurality of types of improvement information.

30. The data processing device as claimed in claim 27, wherein at least the prediction coefficient and information for carrying out linear interpolation are embedded in the embedded data as the plurality of types of improvement information.

31. The data processing device as claimed in claim 27, wherein a plurality of types of prediction coefficients found by using class taps or prediction taps of different structures are embedded in the embedded data as the plurality of types of improvement information.

32. The data processing device as claimed in claim 27, wherein a plurality of types of prediction coefficients found by carrying out classification by different methods are embedded in the embedded data as the plurality of types of improvement information.

33. The data processing device as claimed in claim 27, further comprising improvement information selecting means for selecting improvement information used for improving the quality of the data, from the plurality of types of improvement information.

34. The data processing device as claimed in claim 21, wherein the extracting means extracts the improvement information from the embedded data by using the bias of energy held by the data.

35. The data processing device as claimed in claim 21, wherein the extracting

means extracts the improvement information from the embedded data by carrying out inverse spectrum spreading.

36. The data processing device as claimed in claim 21, wherein the extracting means extracts one or more bits of the embedded data as the improvement information.

37. The data processing device as claimed in claim 21, wherein the data is image data and the improvement information is information for improving the image quality of the image data.

38. A data processing method for processing embedded data obtained by embedding improvement information for improving quality of data into the data, the method comprising:

an extracting step of extracting the improvement information from the embedded data; and

an improving step of improving the quality of the data by using the improvement information.

39. A recording medium having recorded thereon a program to be executed by a computer for processing embedded data obtained by embedding improvement information for improving the quality of data into the data, the program comprising:

an extracting step of extracting the improvement information from the embedded data; and

an improving step of improving the quality of the data by using the

improvement information.

40. A program to be executed by a computer for processing embedded data obtained by embedding improvement information for improving quality of data into the data, the program comprising:

an extracting step of extracting the improvement information from the embedded data; and

an improving step of improving the quality of the data by using the improvement information.

41. A data processing device comprising:

improvement information generating means for generating a plurality of types of improvement information for improving quality of data; and

transmitting means for transmitting the data and one or more types of improvement information.

42. The data processing device as claimed in claim 41, further comprising improvement information selecting means for selecting improvement information to be transmitted together with the data, from the plurality of types of improvement information.

43. The data processing device as claimed in claim 42, wherein the improvement information selecting means selects the improvement information in response to a request from a receiving device which receives the data.

44. The data processing device as claimed in claim 43, further comprising

45. The data processing device as claimed in claim 41, wherein the improvement information generating means generates at least a prediction coefficient used for predicting a prediction value of quality-improved data obtained by improving the quality of the data, as the improvement information.

47. The data processing device as claimed in claim 46, wherein the improvement information generating means comprises:

classifying means for carrying out classification for finding the class of the target teacher data on the basis of the class tap;

prediction coefficient operation means for finding a prediction coefficient for each class by using the teacher data and the prediction tap.

48. The data processing device as claimed in claim 47, wherein the improvement information generating means generates prediction coefficients for different numbers of classes as the plurality of types of improvement information.

49. The data processing device as claimed in claim 47, wherein the improvement information generating means generates a plurality of types of prediction coefficients found by using learner data or teacher data of different qualities, as the plurality of types of improvement information.

50. The data processing device as claimed in claim 47, wherein the improvement information generating means generates at least the prediction coefficient and information for carrying out linear interpolation, as the plurality of types of improvement information.

51. The data processing device as claimed in claim 47, wherein the improvement information generating means generates a plurality of types of prediction coefficients found by using class taps or prediction taps of different structures, as the plurality of types of improvement information.

52. The data processing device as claimed in claim 47, wherein the improvement information generating means generates a plurality of types of prediction coefficients found by carrying out classification by different methods, as the plurality of types of improvement information.

53. The data processing device as claimed in claim 41, wherein the transmitting means embeds the improvement information into the data so that the data and the

improvement information can be restored, by using the bias of energy held by the data, and transmits the data and one or more types of improvement information.

54. The data processing device as claimed in claim 41, wherein the transmitting means embeds the improvement information into the data by carrying out spectrum spreading and transmits the data and one or more types of improvement information.

55. The data processing device as claimed in claim 41, wherein the transmitting means embeds the improvement information into the data by changing one or more bits of the data to the improvement information and transmits the data and one or more types of improvement information.

56. The data processing device as claimed in claim 41, wherein the transmitting means transmits the data and all the plurality of types of improvement information.

57. The data processing device as claimed in claim 41, wherein the data is image data and the improvement information is information for improving the image quality of the image data.

58. A data processing method comprising:

an improvement information generating step of generating a plurality of types of improvement information for improving quality of data; and

a transmitting step of transmitting the data and one or more types of improvement information.

59. A recording medium having recorded thereon a program to be executed by a computer, the program comprising:

an improvement information generating step of generating a plurality of types of improvement information for improving the quality of data; and

a transmitting step of transmitting the data and one or more types of improvement information.

60. A program to be executed by a computer, the program comprising:

an improvement information generating step of generating a plurality of types of improvement information for improving the quality of data; and

a transmitting step of transmitting the data and one or more types of improvement information.

61. A data processing device for receiving and processing data and one or more types of improvement information for improving the quality of the data, the device comprising:

receiving means for receiving the data and the one or more types of improvement information;

improving means for improving the quality of the data by using one of the one or more types of improvement information; and

accounting means for carrying out accounting in accordance with the improvement information used for improving the quality of the data.

62. The data processing device as claimed in claim 61, wherein the receiving means receives a plurality of types of improvement information, the data processing device further comprising improvement information selecting means for selecting

improvement information used for improving the quality of the data, from the plurality of types of improvement information.

63. The data processing device as claimed in claim 62, wherein the improvement information selecting means selects the improvement information in response to a request from a user.

64. The data processing device as claimed in claim 61, further comprising requesting means for requesting a transmitting device which transmits the data and one or more types of improvement information, for the improvement information used for improving the quality of the data,

wherein the receiving means receives the improvement information transmitted from the transmitting device in response to the request of the requesting means.

65. The data processing device as claimed in claim 61, wherein the improvement information is a prediction coefficient used for predicting a prediction value of quality-improved data obtained by improving the quality of the data, and the improving means finds the prediction value of the quality-improved data by using the data and the prediction coefficient.

66. The data processing device as claimed in claim 65, wherein the improvement information is a prediction coefficient found for each predetermined class, and the improving means finds the prediction value of the quality-improved data by using the data and the prediction coefficient for each class.

67. The data processing device as claimed in claim 66, wherein the improving

means comprises:

class tap constructing means for constructing a class tap used for finding the class of target quality-improved data, which is targeted quality-improved data, by using the data;

classifying means for carrying out classification for finding the class of the target quality-improved data on the basis of the class tap;

prediction tap constructing means for constructing a prediction tap used together with a prediction coefficient for predicting the target quality-improved data, by using the data; and

predicting means for finding the prediction value of the target quality-improved data by using the prediction coefficient of the class of the target quality-improved data and the prediction tap.

68. The data processing device as claimed in claim 67, wherein the receiving means receives a plurality of types of improvement information.

69. The data processing device as claimed in claim 68, wherein the receiving means receives prediction coefficients for different numbers of classes as the plurality of types of improvement information.

70. The data processing device as claimed in claim 68, wherein the prediction coefficient is generated by using learner data to be a learner and teacher data to be a teacher, and the receiving means receives a plurality of types of prediction coefficients found by using learner data or teacher data of different qualities, as the plurality of

information;

an improving step of improving the quality of the data by using one of the one or more types of improvement information; and

an accounting step of carrying out accounting in accordance with the improvement information used for improving the quality of the data.

81. A program to be executed by a computer for receiving and processing data and one or more types of improvement information for improving the quality of the data, the program comprising:

a receiving step of receiving the data and the one or more types of improvement information;

an improving step of improving the quality of the data by using one of the one or more types of improvement information; and

an accounting step of carrying out accounting in accordance with the improvement information used for improving the quality of the data.